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Solar Panel Cleaning Robot

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ABSTRACT: The utilization of solar energy has hiked in recent years, leading to a growing need for efficient maintenance of solar panel arrays. This abstract presents a solar panel cleaning robot designed with remote operated cleaning process, enhancing energy output and prolonging panel lifespan. The robot employs specific commands for navigation and obstacle avoidance, ensuring safe and precise operation. Equipped with cleaning brushes and water jets, it effectively removes dust, debris, and other contaminants without damaging the panels. The robot's autonomous functionality, coupled with remote monitoring and control capabilities, offers a cost-effective solution for maintaining large-scale solar installations. Finally, it is carried out using decision support tools and taking into account different relevant criteria to support users choose the right cleaning maintenance for their specific solar installation.

KEYWORDS: Photovoltaic, Microcontroller

I. INTRODUCTION

Nowadays, for the industrial and domestic appliances solar energy is mostly used. As it is installed in the rooftops it is exposed and effected by the dust and dirt particles and other environmental factors like rain, snow and bird droppings [1-3]. Which leads to decrease the generation of solar energy. So manual cleaning is not possible all the times for a regular interval of time.

Manual cleaning not only bother about the labor cost and also it is risk and inefficient. In order to obtain the maximum efficiency and better performance, we came with a device called solar panel cleaning robot which is operated by the remote control by the means of radio frequencies. This robot leverage web monitoring technology [4]. As the robot is on the rooftop the person with in a range can be operated with the suitable commands. These robots offer a scalable, cost effective and environmentally friendly approach to the solar panels.

This introduction sets the stage for exploring the design, functionality, benefits, and challenges associated with solar panel cleaning robots [5]. Through a comprehensive analysis of their capabilities and potential impact on the solar industry, this study aims to underscore the importance of embracing technological innovation in optimizing the performance and sustainability of solar energy systems.

II. BLOCK DIAGRAM

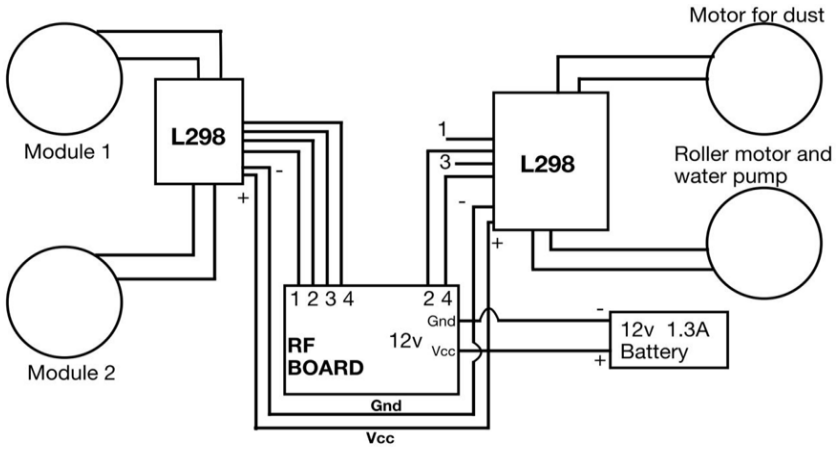

Fig.1 Block Diagram of the proposed system

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From the above Figure.1 module 1 consists of motor 1 and motor 3 which is for directional (front wheels). Module 2 consists of motor 2 and motor 4 it is the rear wheels of the robot. This both the modules are connected to the L298 motor drive module which can be control up to 4 DC motors, or 2 DC motors with directional and speed control.

This L298 motor drive module is a high power motor drive module for driving DC and stepper motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator [6-8]. 78M05 Voltage regulator will be enabled only when the jumper is placed. When the power supply is less than or equals to 12V, then the internal circuitry will be powered by the voltage regulator and the 5V pin can be used as an output pin to power the microcontroller.

Output of the one of the L298 motor drive module is connected to the RF board, used to control the spinning direction of the module 1 and module 2 [9]. And its supply terminals are shorted with another L298 motor drive module, both module are feed by 12V 1.3A lead acid battery. On the other hand, Output of the another L298 motor drive module is connected to the RF board, which is to speed control of the roller motor and water pump and also for the motor for the dust.

Here water pump and paint brush are connected across the supply, i.e both the motor and pump will work on a single command and it is fed at backend of the robot. Dust brush is isolated apart and it is independent and fed at the front end of the robot [10].

Here heavy duty wheels are used for this device to run on the incline panels and also where the surface is difficult to climb with the soft tires.

Lead acid battery is strong enough to supply the power to the specific units. Say: module 1, module 2, pump as well as the paint brush and also to the dust brush.

The supply of the RF board is feed by the battery and also corresponding inputs are connected to the corresponding pins. Depend upon the commands feed by the user the results are going to be obtain. Roller brush and water pump both are operated on a single command. Dust brush is isolated apart with another button.

III. RESULT AND DISCUSSION

Fig 2 solar panel cleaning robot on the solar panel

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Fig 3 customized view of the robot.

As compared with the traditional cleaning system these type of robots will prevent from human hazards and it is environment friendly, because water saving is considered as a vital source and also reduction in chemical usage. By considering all the parameters, such as: efficiency, time taken for cleaning and energy consumption can be analyzed easily.

This is the one of the best cleaning process of solar panel by the remote control. Here both the paint brush and water pump will automatically turn ON by the single instruction fed by the user. Dust cleaner is isolated apart and operated by another command. The robot can rotate 360 degrees as per the user choice. Table. 1 are the system parameters used to develop the project.

Table. 1 SYSTEM PARAMETERS

SYSTEM PRAMETERS	RATINGS/ TYPE	QUANTIITY
L298 motor drive	2A	2
Lead acid battery	Voltage: 12v Current: 1.3A	1
Motor	60 r.p.m	6
Remote control	Radio frequency	1
Metal chassis	Metal	1
Water pump	6v DC	1
Water tank	Cylindrical	Adequate
Wheels	-	4
Paint brush	-	1
Roller brush	-	1

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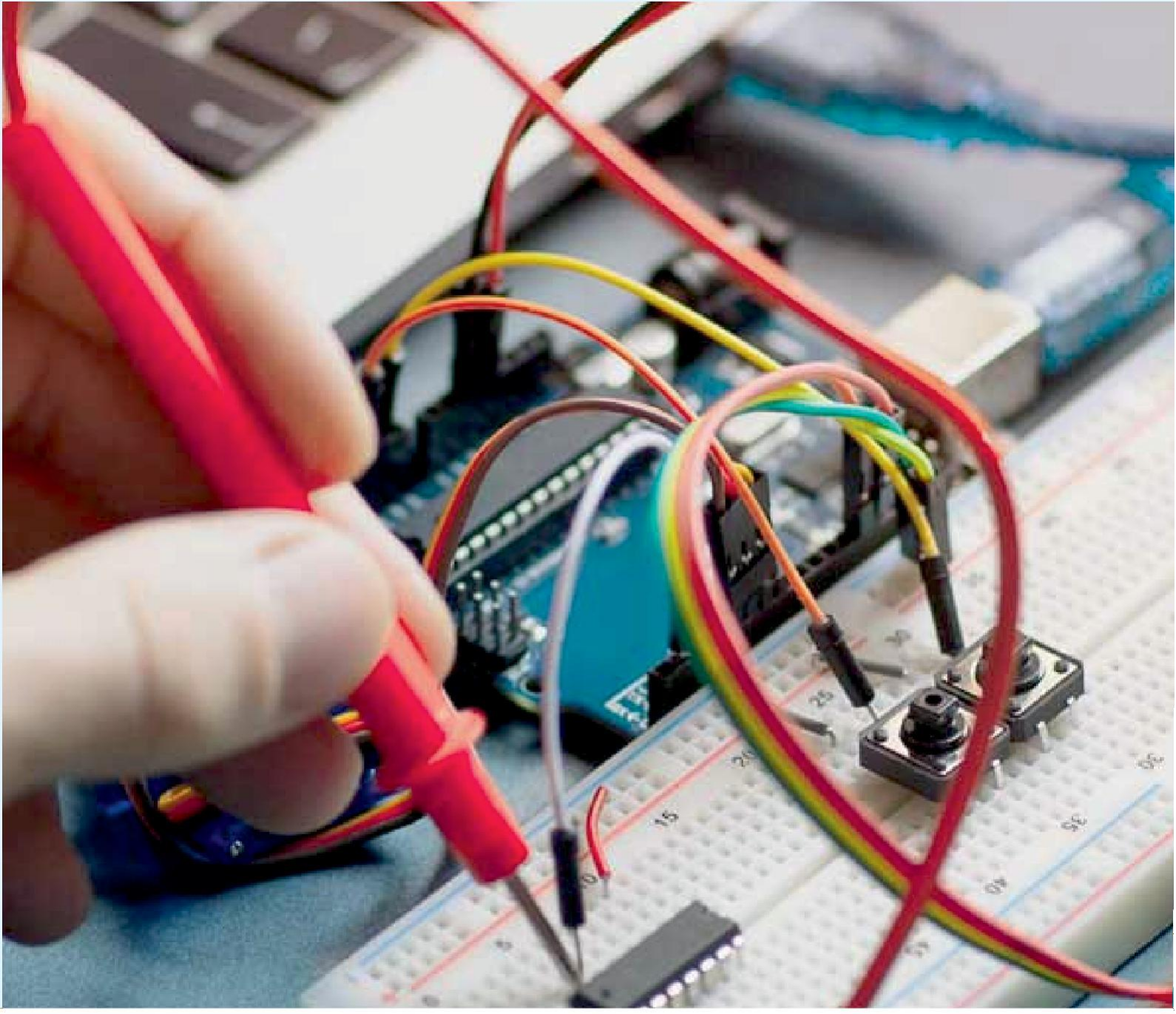
IV. CONCLUSION

To obtain the consistent electrical energy, maintenance of solar panel is required in order to obtain maximum efficiency and reliability. To achieve that, one of the cleaning methods is remote control cleaning robot, which can be operated by the remote instructions fed by the user and also it can be communicated by the radio frequencies. The robot aim is to remove dust on the panel by blowing the air and also using liquid to clean and roller is to wipe out. Depend upon the requirement the user can use any of the cleaning method.

REFERENCES

1. Chirag, D., Mayank, G., Mandipsinh, J., & Parimal, P. (2017). Design And Development Of Solar Panel Cleaning Machine. *International Journal Of Advance Engineering And Research Development*.
2. Patil, S. A., Patil, A. R., Chougule, V. N., & Sanamdikar, S. T. Design and Analysis of Automated Solar Panel Cleaning System.
3. Eiche, J. F., Bamidele, O. O., Fadiji, E. A., & Mogaji, T. S. (2023). Design and Construction of an Automatic Solar Panel Cleaning System. *Saudi J Eng Technol*, *8*(12), 293-299.
4. Dabhi, C., Gandhi, M., Jadeja, M., & Prajapati, P. (2017). Design and development of solar panel cleaning machine. *Int J Adv Eng Res Dev Special*, (1-4).
5. Biswas, S., Bhuyan, M. H., & Hassan, M. K. (2023). IoT-based Automated Solar Panel Cleaning and Monitoring Technique. *Journal of Engineering Research and Reports*, *25*(8), 56-69.
6. Adinoyi, M. J., & Said, S. A. (2013). Effect of dust accumulation on the power outputs of solar photovoltaic modules. Renewable energy, 60, 633-636.
7. Mani, M., & Pillai, R. (2010). Impact of dust on solar photovoltaic (PV) performance: Research status, challenges and recommendations. Renewable and sustainable energy reviews, 14(9), 3124-3131.
8. Jiang, H., Lu, L., & Sun, K. (2011). Experimental investigation of the impact of airborne dust deposition on the performance of solar photovoltaic (PV) modules. Atmospheric environment, 45(25), 4299-4304.
9. Mondal, A. K., & Bansal, K. (2015). Structural analysis of solar panel cleaning robotic arm. Current Science, 108(6), 1047-1052.
10. Lamont, L. A., & El Chaar, L. (2011). Enhancement of a stand-alone photovoltaic system's performance: Reduction of soft and hard shading. Renewable Energy, 36(4), 1306-1310.



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